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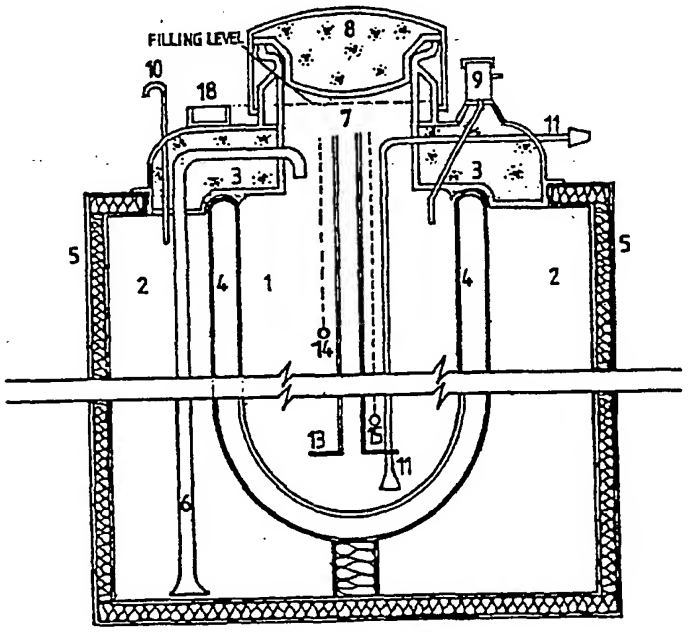
(54) Heated screen wash reservoir

(57) A heated and insulated reservoir for use in a vehicle screen washer system has an insulated inner chamber 1 located within an insulated outer chamber 2 and closed by an insulated capping arrangement 3 provided with an air vent 10 above the outer chamber and a sealable filling opening 7 above the inner chamber. A syphon 6 connects the chambers. Water is withdrawn from the inner chamber through pipe 11 for discharge against a vehicle screen. A thermostatically controlled heater 13 maintains the temperature of water in the inner chamber at a set value in the range 25-70 degrees when the engine is running, while the insulation keeps the water warm when the engine is switched off. An additional compartment may be provided for deicing fluid (22, Figs 6, 7).

Figure 1



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MOTOR VEHICLE DEICING DEVICE

The present invention relates to a device for the deicing and cleaning of external surfaces and demisting of internal surfaces of the windscreen and other windows of a motor vehicle, even after the vehicle has been at rest with the engine switched off for some time in cold climates, without drawing on the vehicles electrical storage battery reserves.

More particularly it relates to a system which heats a part of the water supply normally carried by vehicles, for the purpose of cleaning their windscreens, while the vehicle's engine is running and maintains it in a heated condition for long periods after the engine is switched off. Conservation of the window wash water's heat content ensures that its temperature is high enough to melt any ice formed on the windscreen and other windows of the vehicle when the vehicle is next started from cold and the heated water is distributed onto their external surfaces. In addition to the removal of ice, the temperature of the glass is raised to prevent reformation of ice on its external surface and facilitate demisting of its internal surface. The heated water is distributed on the glass surfaces by a pump action windscreen-washing system of the type commonly fitted to motor vehicles during manufacture using the systems existing wash fluid spray nozzles or optionally modified nozzles described herein or a,separate, dedicated, distribution system installed for the purpose.

In cold climates the users of motor vehicles are plagued by the formation of ice on their vehicles windscreen and other windows when the vehicle is parked with its engine switched off for any length of time. The formation of ice on the external surfaces of the vehicles windows is both troublesome, in that it often hinders the operation of the vehicles windscreen wipers and has to be scraped away by mechanical means with consequent inconvenience and risk of damage, and hazardous, in that it obscures the drivers vision. A further hazard associated with ice formation on the external surfaces of motor vehicles is the misting-up of the internal surfaces of windscreens and other windows. Ice deposits on external glass surfaces maintain the temperature of the glass and therefore its internal surface at or below 0° Celsius as the vehicles internal

atmosphere heats up due to the drivers and/or passengers body heat. A temperature gradient is created at the internal surface with the air next to it cooling down below its "Dew point" and depositing it's excess water content on the surface in the form of small droplets, obscuring the drivers vision. Mechanical removal of these droplets (mist) is of no avail while ice persists on the external surface due to continued deposition of droplets while the temperature gradient persists. Motor vehicles usually incorporate a hot air blower which directs a stream of heated air onto internal glass surfaces as a demisting aid. However, such devices normally derive their heat from the vehicles heating system which, is plumbed into the engines cooling system, and are therefore inefficient when the vehicles engine is cold and before the engine cooling system has warmed up. The time delay between switching on the engine and hot air blower and the removal of the vision impairing mist is both inconvenient and hazardous. By removing ice deposits from, and warming up external surfaces, the device facilitates any demisting mechanism in use.

Previous attempts to solve the problem of iced over motor vehicle windscreens have resulted in the development of various devices to distribute heated fluid onto the windscreen to melt away the ice and the fluid which is heated is often that contained in the reservoir of the conventional windscreen washing system, installed in most motor vehicles. Many of these prior art deicing devices utilise an electrical heating means for warming the washer fluid to be distributed on the windscreen. Such devices are disclosed in US Pat Nos 3319891 and 3427675 and DE 1909956. This type of device does not overcome the problem of the time delay between switching on the motor vehicle and the availability of heated windscreen washer fluid when the engine is cold, after a period during which the vehicle has been parked at low temperatures. A further disadvantage of this type of deicer is that there is a major drain on the motor vehicles electrical storage battery. Such a drain on the vehicles battery reduces its life expectancy and may result in it not having sufficient energy to start the engine if the deicing system is used for long periods

of time, which often corresponds with periods of maximum strain on the battery.

Other prior art deicers heat the windscreen washer liquid by some type of heat exchange arrangement with the engines cooling system. Such devices are disclosed in British Pat No 2146237,European Pat Nos 5414,261005 and 454919, and US Pat Nos 3243119, 3292866, 3632042, 4090668 and 4862951. Deicers which utilise the heat of the engines cooling system to heat up the wash liquid avoid a drain on the vehicles battery but have the disadvantage that, when the engine is started from cold, heated water may not be immediately available. An inconvenient period of time must elapse while the cooling system warms up and exchanges a sufficient amount of heat with the washer liquid to raise its temperature to a level capable of melting ice when distributed on the windscreen. This type of prior art deicer also possess disadvantages in terms of its construction, which is complicated by the need for sophisticated valving systems to control the heat exchange process and prevent boiling of the fluid under normal driving conditions when the temperature of the cooling system can exceed 100 degrees celsius, and fitting to the vehicle, which involves modification of the cooling system.

Devices have also been disclosed in the prior art, utilising both electrical and cooling system heat exchangers, for providing warm washing fluid immediately the motor vehicle is switched on by heating the washer water only while the vehicles engine is running and storing the heated water in a thermally insulated reservoir while the engine is at rest. Such devices are disclosed in British Patent 1451666, US Pat 5118040 and JP 5812851. Prior art devices of this type solve, in principle, the problem of making available a supply of hot wash fluid for distribution on the windscreen immediately the motor vehicle is switched on but suffer a number of serious disadvantages.

Those based on heat exchange with the vehicle cooling system require re-configuration of the cooling system, a dedicated circulation pump to drive the heat exchange process and a valving system to control heat exchange and prevent over heating of the wash fluid. Those based on

electrical heating elements require a second, separate, wash liquid reservoir either linked to the first by a pump system or positioned relative to the first, thermally insulated reservoir, in such a manner as to provide gravity flow replenishment of hot water pumped out of the first reservoir onto the vehicles windscreen.

According to the present invention there is provided a water heating,storage and distribution device, connectable to the windscreen washing liquid distribution system of a motor vehicle, providing a supply of heated liquid for distribution on the vehicles windscreen and/or other windows, comprising:

a, first, thermally insulated container,

a, second, thermally insulated container,

said first container being located within the second container in a thermally insulated manner with a means being provided for enabling filling of said container, means for enabling said first container to be replenished from said second container, means for maintaining the temperature of the liquid in the said first container at a predetermined temperature, and a means of withdrawing heated liquid from said first container for supply to, the vehicles windscreen wash liquid distribution pump.

Preferably, there is provided a water heating,storage and distribution device, for connection to the windscreen washing liquid distribution system of a motor vehicle, providing a constantly available supply of heated water for distribution on the vehicles windscreen and, optionally, other windows. The device comprises;

i) a, first, open ended container possessing thermally insulating walls suspended within,

ii) a, second, open ended and thermally insulated container and,

iii) a thermally insulating capping arrangement which securely locates the first container within the second container and closes both their open ends to form separate inner and outer chambers. The capping arrangement is provided with at least one air vent, located above the outer

chamber, and a hermetically sealable water filling orifice, located above the inner chamber. The two separate chambers are linked only by,

iv) a syphon system connecting the top of the water heating chamber to the bottom of the outer chamber. The maximum height of the syphon tube as it passes over the intervening wall being at least 10 mm below the maximum fill level of the heating chamber. The thermally insulating and hermetically sealable water heating chamber is provided with,

v) a means of heating its contents to a thermostatically controlled temperature within the range 25°C to 70°C while the vehicles engine is running and a means of withdrawing heated water from its lower regions to the vehicles windscreen wash liquid distribution pump.

Whilst primarily intended for use in automobiles, it is understood that the invention may be used in any type of vehicle such as aeroplane, boats or trains having windows or surfaces which must be kept clear of ice.

The invention is now described by reference to figures 1 to 14.

Figure 1 : Basic Elements of the Device - Cross Section

Figure 2 : Capping Arrangement - Cross Section

Figure 3 : Capping Arrangement - Plan

Figure 4 : Inner Chamber Holder - Cross Section

Figure 5 : Inner Chamber Holder - Plan

Figure 6 : Outer Chamber with Deicing Fluid Reservoir - Plan

Figure 7 : Outer Chamber with Deicing Fluid Reservoir - Cross Section

Figure 8 : Optional Capping Arrangement - Plan

Figure 9 : Alternative Optional Capping Arrangement - Plan

Figure 10 : Installation (Engine Compartment) - Schematic

Figure 11 : Installation (Dedicated System) - Schematic

Figure 12 : Water Distribution System (Multi-nozzle) - Schematic

Figure 13 : Installation (Rear) - Schematic

Figure 14 : Heated Water Spraying Nozzle

Reference numbers in the figures relate to the following components :-

1 Inner chamber
2 Outer chamber
3 Capping arrangement
4 Inner container wall
5 Outer container wall
6 Syphon tube
7 Water filling orifice
8 Water filling orifice closure
9 Pressure relief valve
10 Air vent
11 Water withdrawal pipeline
12 Pump
13 Heating element
14 Thermostat temperature sensor
15 Water level indicator
16 Wash liquid distribution system
17 Heater assembly plug
18 Thermostat platform/housing
19 Fixing strips
20 Inner chamber holder
21 Outer chamber partitioning wall
22 Additional (deicer) reservoir
23 Deicer reservoir filling orifice
24 Deicer reservoir closure
25 Deicer fluid withdrawal pipeline
26 Time controlled mixer valve
27 Deicer fluid on/off valve
28 Spacer
29 Flow control valve
30 Flow control valve controller

The basic elements of the invention are shown in figure 1. A first, inner, container of double vacuum sealed wall construction, commonly referred to as a "Dewar flask" (4) is positioned within a second, outer, container (5) with thermally insulating walls. Both containers are mutually closed by a thermally insulating capping arrangement (3) to form separate inner (1) and outer (2) chambers. The only connection between the otherwise isolated chambers is a syphon tube (6) running from the top of the inner chamber (1), over the inner chamber wall (4), to the bottom of the outer chamber (2). The highest point of the syphon tube (6), as it passes between

the two chambers through the capping arrangement (3), must be below the fill level of the inner chamber (1).

The capping arrangement (3) is shown in more detail in figure 2 (section) and figure 3 (plan). It is designed in such a manner as to secure the upper walls of the two containers relative to each other, form the separate inner (1) and outer (2) chambers and provide them with a thermally insulating closure. The arrangement is at least 20 mm thick above the inner chamber (1), to allow the required relative positions of the highest point in the syphon tube (6) and the device's filling level to be achieved, and is provided with a filling orifice (7), occupying less than half the area of the capping arrangement immediately above the inner chamber, a filling orifice closure (8), which may be of any convenient design provided it is capable of thermally insulating and hermetically sealing the inner chamber (1), and a pressure relief valve (9) above the inner chamber (1), to guard against the build up of excessive positive or negative pressure within the chamber. The capping arrangement is also provided with an air vent (10) positioned above the outer chamber (2), the outlet of which is higher than the highest point in the syphon system (6). A liquid withdrawal pipeline (11) passes from the bottom of the inner chamber (1), through the capping arrangement (3) and connects with a pump (12), which is preferably of the self-draining type, to allow liquid to be withdrawn from the inner chamber (1) and distributed on the vehicles windows through the windscreen washing liquid distribution system (16).

In use, both chambers are filled with water by way of the filling orifice (7), the syphon (6) conducting the water from the inner chamber (1) to the outer chamber (2) until both chambers are full. The closure (8) is used to hermetically seal the inner chamber (1) so that, once sealed, water withdrawn from the inner chamber (1), through withdrawal pipeline (11), is replaced by water from the outer chamber (2) through the syphon (6).

The inner chamber (1) is provided with a thermostatically controlled electrical heating element (13), a temperature sensor (14), to control the thermostat, and a water level detector

(15), to switch off the heating element (13) when the water level in the chamber (1) falls below the level of the heating element, all of which pass through the capping arrangement (3) by way of a, replaceable, plug (17). The heater control circuitry is integrated and located conveniently within or on (18) the upper surface of the capping arrangement as indicated in figure 3, presenting a simple terminal block which is connected directly to the vehicles electrical system using normal safety precautions.

In use, the contents of the inner chamber (1) are heated to a thermostatically controlled temperature within the range 25°C to 70°C, preferably 35°C to 60°C, most preferably 45°C to 55°C, while the vehicle's engine is running and the combination of the thermally insulating properties of the inner chamber walls and the capping arrangement prevent excessive reduction in the temperature of the chamber contents while the vehicles engine is switched off and the vehicle is left for long periods, for example 24 to 48 hours, in cold conditions. The device thus ensures that a supply of heated water is immediately available for deicing and facilitating the demisting of the vehicles windscreen and other windows when the vehicle is next used.

The container (4) used to form the inner chamber (1) is fabricated from a glass or other materials which are not corroded by water, such as stainless steel, polycarbonate plastics or polyethylene, and is constructed in the form of sealed double walls separated by a vacuum, to provide the inner chamber (1) with adiabatic storage properties. It is preferred that the inner surface of the inner wall of chamber (1) is provided with a reflective surface when the material of construction is opaque or that the inner surface of the outer wall is provided with a mirror coating when the material of construction is transparent. The inner container (4) may take any open ended form and the inner chamber (1) preferably takes the form of a closed cylinder with a capacity of from 250cc to 5000cc, preferably 500cc to 2500cc, most preferably 750cc to 1500cc.

The container (5) used to form the outer chamber (2) is constructed from any suitable

rigid and impact resistant material such as steel, fibre glass or thermo-plastic polymers such as nylon, polyethylene, polypropylene, UPVC, polycarbonate plastic and is preferably of double walled construction with the inter-wall space filled with a thermally insulating material such as cork, felt, glass fibre, expanded polystyrene or any suitable polymer foam. Figures 4 and 5 show a preferred form of the outer container (5) which is constructed with a guide and holder (20) for the inner chamber (1) to facilitate assembly and add strength to the device. During assembly of the device, the inner container (4) is lowered into the integral holder (20) to rest on a spacer (28) at it's base. The dimensions of the holder are such as to leave a small gap between its inner surface and the outer wall of the inner container when the capping arrangement (3) is fitted and the two separate chambers are formed. Thermally insulating polymer foam is injected into the capping arrangement to fill all voids and is forced into the gap between the inner chamber (1) and the holder (20) thus fixing the inner chamber and providing it with additional thermal insulation.

The outer chamber (2) can be formed to any shape which accommodates the inner chamber (1) and conforms to the contours of the motor vehicles engine compartment, or other areas of the vehicles structure where it is to be installed. It is preferably provided with means of facilitating it's attachment to the vehicles structure such as the edging strips (19) which can be drilled to allow passage of securing bolts.

The capacity of the outer chamber (2) is such as to accommodate the water heating, inner, chamber (1) and provide an additional water storage reservoir in the outer chamber (2) of from 0.75 to 5.0 times, preferably 1.5 to 3.0 times, most preferably 2.0 to 2.5 times the capacity of the inner chamber (1).

The pipeline (11), used for withdrawing heated water from the inner chamber (1), may be fabricated from any heat resistant thermoplastic polymer, such as polyethylene, polypropylene, polyvinylchloride or nylon, with an internal diameter within the range 2 mm

rigid and impact resistant material such as steel, fibre glass or thermo-plastic polymers such as nylon, polyethylene, polypropylene, UPVC, polycarbonate plastic and is preferably of double walled construction with the inter-wall space filled with a thermally insulating material such as cork, felt, glass fibre, expanded polystyrene or any suitable polymer foam. Figures 4 and 5 show a preferred form of the outer container (5) which is constructed with a guide and holder (20) for the inner chamber (1) to facilitate assembly and add strength to the device. During assembly of the device, the inner container (4) is lowered into the integral holder (20) to rest on a spacer (28) at it's base. The dimensions of the holder are such as to leave a small gap between its inner surface and the outer wall of the inner container when the capping arrangement (3) is fitted and the two separate chambers are formed. Thermally insulating polymer foam is injected into the capping arrangement to fill all voids and is forced into the gap between the inner chamber (1) and the holder (20) thus fixing the inner chamber and providing it with additional thermal insulation.

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The pipeline (11), used for withdrawing heated water from the inner chamber (1), may be fabricated from any heat resistant thermoplastic polymer, such as polyethylene, polypropylene, polyvinylchloride or nylon, with an internal diameter within the range 2 mm

to 20 mm, preferably 3 mm to 10 mm, most preferably 4 mm to 8 mm, selected to cope with the different flow rates demanded by different size vehicles and allowed by different size pumps (12). The pipeline (11) is preferably insulated against heat loss from it's exposed lengths between the inner chamber (1) and pump (12). Suitable means of thermally insulating exposed lengths of the pipeline (11), and other water carrying pipelines associated with the heated water distribution system (16), are disclosed in GB 2044601 and US 3292866 and may be used with the device, as may any other means of insulating against heat loss. It is preferred that this thermal insulation is provided by a jacket of wire mesh surrounding the pipeline covered by a second, external, jacket of thermoplastic polymer or rubber to provide an insulating layer of trapped air around the pipeline (11).

The syphon tube (6) is fabricated from any suitable thermoplastic polymer or rubber composite material and it's inside diameter is preferably similar to that of the heated water withdrawal pipeline (11), in order to balance inflow to and outflow from the inner chamber (1).

Figures 6 and 7 show an optional form of the invention in which the outer chamber is provided with partitioning walls (21), which may be of the same construction as the outer walls, between the outer wall (5) and the preferred centrally mounted inner chamber holder (20) in order to create a separate reservoir (22), for storage of concentrated deicing fluid. Any proprietary deicing fluid, such as those based on alkyl alcohols and ethylene or propylene glycols, may be stored in the reservoir and be withdrawn by pump (12) for distribution on the vehicle's windows, preferably for a short period of time prior to withdrawal of heated water from the inner chamber (1). An arrangement of the partitioning walls (21) is shown in figure 6 but they may be positioned in any manner to provide an adequate supply of deicing fluid relative to the total capacity of the device without reducing the capacity of the outer chamber (2) excessively. The capacity of this additional deicing fluid reservoir (22) is in the range 0.10

to 0.21 times the total capacity of the device, preferably 0.15 to 0.19 times, most preferably 0.17 to 0.18 times the total capacity of the device.

In this optional form of the invention, the capping arrangement (3) is modified, as shown in figure 8, to incorporate a filling orifice (23), which can be closed by vented closure (24), above the deicing fluid reservoir (22). Deicing fluid is withdrawn from the bottom of the reservoir (22), by means of a pipeline (25) constructed from any suitable material with an internal diameter 2 mm to 8 mm, preferably 2 mm to 6 mm, most preferably 3 mm to 5 mm, to the pump (12). The path taken by the withdrawal pipeline (25) from the bottom of reservoir (22) to the pump (12) is not critical. Figure 7 shows two alternative routes, one through the capping arrangement pipeline (25) and one through the outer wall of the reservoir (25a). In order to conserve deicing fluid during periods of the year when climatic conditions do not normally require its use, a simple on/off valve (27) may be incorporated in the deicing fluid withdrawal pipeline (25 or 25a) just after it leaves the deicing fluid reservoir.

In order to achieve control over the relative proportions and sequence of deicing fluid and heated water withdrawal while avoiding the need for separate deicing fluid and heated water pumps, a means of merging the heated water and deicing fluid withdrawal pipelines and controlling flow through them may be incorporated into the system before it reach the pump (12).

Non-limiting examples of such flow control systems are shown in figures 8 and 9. In figure 8 the deicing fluid withdrawal pipeline (25) and heated water withdrawal pipeline (11) converge at a mixing control valve (26) such as have been disclosed in GB 1451666. The mixing control valve (26) may be used to switch the supply line to the pump (12) sequentially between the heated water withdrawal pipeline (11) and the deicing fluid withdrawal pipeline (25 or 25a) and then back again after a preset time period; the sequence being activated by switching on the pump (12). The inputs to the mixing valve (26) are arranged such that before it is activated the

pump draws only from the heated water withdrawal pipeline (11). When the valve (26) is activated, by switching on the pump (12), it switches to draw only from the deicing fluid withdrawal pipeline (25 or 25a) and maintains this configuration for a preselected period of time within the range 0.1 to 10.0 seconds, preferably 0.5 to 5.0 seconds, most preferably 1.0 to 3.0 seconds, before switching back to its original, rest, configuration and draws only from the heated water withdrawal pipeline (11) again. In figure 9 the same flow control is achieved by a simple merging of the two withdrawal pipelines each of which incorporates a flow control valve (29) located before the merger. The separate flow control valves are linked through a control circuit (30) to allow flow through only one withdrawal pipeline at any time and switch the flow between the deicer fluid and heated water withdrawal pipelines as described above. Optionally, the mixing control valve (26) or flow control valve control circuit (30) may incorporate a circuit breaker controlled manually or by a thermostat linked to a temperature sensor mounted on the external surface of the vehicle, preferably close to the vehicles windscreen, which temporarily disables the activation circuit when the external temperature exceeds a preset temperature in the range 2°C to 10°C. The period of time during which deicing fluid alone is allowed to be withdrawn by pump (12) before the valve switches to withdraw heated water may also be adjusted either manually or by a thermostat, controlled by a temperature sensor mounted on the external surface of the vehicle, in order to ensure that the amount of deicing fluid used by the device is related to the prevailing climatic conditions.

In a first embodiment of the invention, the device, as described above, may be used as a replacement for the conventional windscreen " wash bottle" of a motor vehicle (Figure 10). The outer container (5) may be constructed to dimensions appropriate to fit the space within the vehicle previously occupied by the conventional wash fluid bottle and formed to a shape allowing secure attachment of the device to the structure of the vehicle. The heating element electrical circuit, thermostat electrical circuit and low fluid level cut out device circuit

are integrated and incorporated within or on the surface of the capping arrangement, as shown in figure 3 or 8, to create a single terminal point for simple connection to the vehicles electrical circuits. The heated water withdrawal pipeline (11) and, when appropriate, the optional deicing fluid withdrawal pipeline (25) are connected to the vehicles existing wash liquid distribution system either directly or by means of a suitable mixing control valve (26) or flow controlled merger system (29), as shown in figures 2, 8 and 9.

When fitted to a motor vehicle the device provides a convenient and efficient windscreen deicing and demisting system immediately the vehicles ignition is switched on. The simple procedures required to incorporate this first embodiment of the invention into a motor vehicle, as a replacement for its conventional windscreen washer system, to upgrade the washer system to a washer, deicer and demisting system render it useful for DIY applications.

In a second embodiment of the invention the device may be fitted to the vehicle as a dedicated deicing and demisting system,separate from any windscreen washing system, and independently controlled by the vehicles driver.

In a third embodiment of the invention the device may be connected to a multi-nozzle wash fluid distribution system and is preferably built in to the vehicles structure during it's manufacture. The spray nozzles used to distribute heated water on the windscreen and other surfaces of the vehicle may optionally incorporate electrical heating elements, as disclosed in US 3319891 and US 4088269 in order to prevent their blockage by freezing of water residues left over from their last use. The configuration of the distribution system may be any which directs the heated water, and optionally deicing fluid, onto the vehicles windscreen, side windows and optionally the rear view window. Non-limiting examples of such heated water distribution configurations and spray nozzle designs are shown in figures 12 and 14. It should be understood that, wherever possible, heated water carrying pipelines in such systems are thermally insulated as described above.

In a fourth embodiment of the invention the device may be may be installed in an area of the vehicle's structure other than the engine compartment, such as in the luggage compartment, and the capacity of the outer chamber (2) relative to the inner chamber (1) may be increased to a factor of from 1.5 to 10.0 times, preferably 3.0 to 6.0 times, most preferably 4.0 to 5.0 times the capacity of the inner chamber. In this embodiment of the invention the device is preferably built into the vehicle during manufacture when the filling orifice (7) may be engineered into the external surface of the vehicle to allow convenient replenishment of the outer chamber. A non-limiting example of such an arrangement is shown is shown in figures 13.

In a fifth embodiment of the invention the device may be fitted to the underside of the chassis of large, high axel height, vehicles such as heavy duty goods vehicles, public transport vehicles, etc. In this embodiment of the invention the capacity of both the inner (1) and outer (2) chambers may be increased and the outer of the outer container walls are constructed to withstand impact, from road debris,etc, preferably being constructed from steel. It is often necessary for such vehicles to undertake long journeys in bad weather conditions and it may be desirable to ensure that the total capacity of the device is sufficient to accommodate a large number of uses between service stops. This may be achieved by continuous replenishment of the outer chamber (2) from a separate water storage tank, located in a convenient position elsewhere in the vehicle, either by gravity feed or by the action of a dedicated pump, preferably triggered by a water level detector in the outer chamber, incorporating a non-return valve.

In a sixth embodiment of the invention the heated water withdrawal pump (12) may be activated independently of the vehicles ignition switch and by remote control. The advantage of this embodiment of the invention is that it allows the driver to start the deicing and demisting process before entering the vehicle.

CLAIMS

CLAIM 1. A water heating, storage and distribution device, for connection to the windscreen washing liquid distribution system of a motor vehicle, providing a constantly available supply of heated water for distribution on the vehicles windscreen and, optionally, other windows comprising;

i) a, first, open ended container possessing thermally insulating walls suspended within,

ii) a, second, open ended and thermally insulated container and,

iii) a thermally insulating capping arrangement which securely locates the first container within the second container and closes both their open ends to form separate inner and outer chambers. The capping arrangement is provided with at least one air vent, located above the outer chamber, and a hermetically sealable water filling orifice, located above the inner chamber. The two separate chambers are linked only by,

iv) a syphon system connecting the top of the water heating chamber to the bottom of the outer chamber. The maximum height of the syphon tube as it passes over the intervening wall being at least 10 mm below the maximum fill level of the heating chamber. The thermally insulating and hermetically sealable water heating chamber is provided with,

v) a means of heating its contents to a thermostatically controlled temperature within the range 25°C to 70°C while the vehicles engine is running and a means of withdrawing heated water from its lower regions to the vehicles windscreen wash liquid distribution pump.

CLAIM 2. A device as claimed in claim 1 wherein the container used to form the water heating chamber is constructed of sealed double walls separated by a vacuum and is fabricated from stainless steel,polycarbonate plastic or glass, preferably glass with a mirrored internal surface, and the inner chamber has a capacity of from 250cc to 5000cc.

CLAIM 3. A device as claimed in claim 1 or claim 2 wherein the container used to form the outer compartment is constructed in the form of a double wall of water impermeable and impact resistant materials such as steel, polyethylene, unplasticised-polyvinylchloride or polycarbonate plastic with the inter-wall space filled with a thermally insulating material such as expanded polystyrene, and can be formed to any shape which accommodates the water heating chamber and conforms to the contours of the motor vehicles engine compartment, or other areas of the vehicles structure where it is to be installed, and is provided with means of securing it to the vehicles structure. Its capacity is such as to accommodate the water heating chamber and provide

an additional water storage reservoir in the outer compartment of from 0.75 to 5.0 times the capacity of the water heating chamber.

CLAIM 4. A device as claimed in claims 1 to 3 wherein the thermally insulating capping arrangement is constructed as an outer casing of thermoplastic polymer material filled with a thermally insulating material such as cork, expanded polystyrene or polyurethane foam and is at least 20 mm thick in the area above the inner chamber. It is provided with a filling orifice and a pressure relief valve above the inner chamber. The filling orifice is provided with a closure of thermally insulating material capable of hermetically sealing the inner chamber. The thermally insulated capping arrangement is also provided with channels to accommodate the syphon tube, as it passes over the inner chamber wall, allow entry of the means of heating the contents of the inner chamber to a thermostatically controlled temperature and optionally to accommodate the heating element/thermostat control systems.

CLAIM 5. A device as claimed in claims 1 to 4 wherein the means of heating and thermostatically controlling the temperature of water in the,inner, water heating chamber is an electric heating element controlled by a thermostat, within the range 25°C to 70°C, and by an electrical cut-out device connected to a water level detector located within the chamber, to prevent heating when the water level falls below the height of the heating element. The sensors for both controllers and the heating element itself pass through the capping arrangement which, optionally, also accommodates the necessary electrical circuitry, the terminals of which are positioned on an accessible external surface of the device and connected to the vehicles electrical circuit.

CLAIM 6. A device as claimed in claims 1 to 5 wherein the outer container is constructed in such a manner as to create an additional and separate storage compartment, within the outer compartment, having a capacity of from 0.10 to 0.21 times the total capacity of the device, for the storage of a proprietary deicing fluid. The thermally insulating capping arrangement is modified to isolate the additional storage compartment from the outer storage compartment, provide it with a closable filling orifice, an air vent and a pipeline, possessing an internal diameter of from 2 mm to 8 mm, running from the bottom of the additional storage compartment to the vehicles windscreen wash liquid pump, to allow the withdrawal of deicing fluid as well as heated water for distribution on the vehicles windows. A simple on/off valve may be incorporated into the deicing fluid withdrawal pipeline to permit manual closure of the

an additional water storage reservoir in the outer compartment of from 0.75 to 5.0 times the capacity of the water heating chamber.

CLAIM 4. A device as claimed in claims 1 to 3 wherein the thermally insulating capping arrangement is constructed as an outer casing of thermoplastic polymer material filled with a thermally insulating material such as cork, expanded polystyrene or polyurethane foam and is at least 20 mm thick in the area above the inner chamber. It is provided with a filling orifice and a pressure relief valve above the inner chamber. The filling orifice is provided with a closure of thermally insulating material capable of hermetically sealing the inner chamber. The thermally insulated capping arrangement is also provided with channels to accommodate the syphon tube, as it passes over the inner chamber wall, allow entry of the means of heating the contents of the inner chamber to a thermostatically controlled temperature and optionally to accommodate the heating element/thermostat control systems.

CLAIM 5. A device as claimed in claims 1 to 4 wherein the means of heating and thermostatically controlling the temperature of water in the,inner, water heating chamber is an electric heating element controlled by a thermostat, within the range 25°C to 70°C, and by an electrical cut-out device connected to a water level detector located within the chamber, to prevent heating when the water level falls below the height of the heating element. The sensors for both controllers and the heating element itself pass through the capping arrangement which, optionally, also accommodates the necessary electrical circuitry, the terminals of which are positioned on an accessible external surface of the device and connected to the vehicles electrical circuit.

CLAIM 6. A device as claimed in claims 1 to 5 wherein the outer container is constructed in such a manner as to create an additional and separate storage compartment, within the outer compartment, having a capacity of from 0.10 to 0.21 times the total capacity of the device, for the storage of a proprietary deicing fluid. The thermally insulating capping arrangement is modified to isolate the additional storage compartment from the outer storage compartment, provide it with a closable filling orifice, an air vent and a pipeline, possessing an internal diameter of from 2 mm to 8 mm, running from the bottom of the additional storage compartment to the vehicles windscreen wash liquid pump, to allow the withdrawal of deicing fluid as well as heated water for distribution on the vehicles windows. A simple on/off valve may be incorporated into the deicing fluid withdrawal pipeline to permit manual closure of the

deicing fluid pipeline during periods when climatic conditions do not require the use of deicing fluid.

CLAIM 7. A device as claimed in claim 6 wherein the withdrawal of deicing fluid from it's separate storage compartment by the vehicles windscreen wash liquid pump is automatically controlled by a mixing or flow control valve system. The system is activated when the pump is switched on and allows withdrawal of deicing fluid for from 0 to 10 seconds prior to withdrawal of heated water from the, inner, water heating chamber. The period during which the deicing fluid is automatically withdrawn may be controlled by a manual adjustment of the mixing or flow control valve system or, optionally, by a temperature sensing device located on the external surface of the vehicle and acting through a thermostat preset to reduce the period of deicing fluid withdrawal as the external temperature of the vehicle increases above 0°C, to allow for changing climatic conditions.

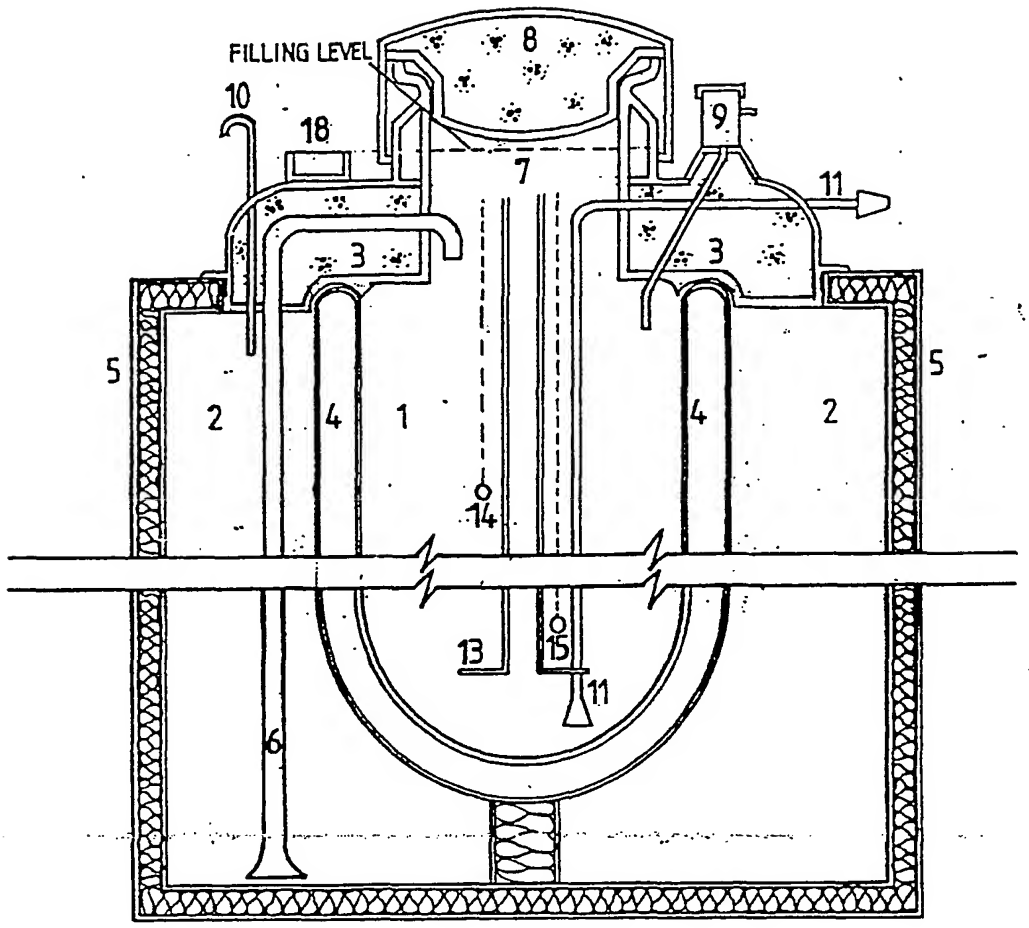
CLAIM 8. A device as claimed in claims 6 or 7 wherein the heated water and deicing fluid withdrawal and distribution system is dedicated, separate from the windscreen wash water distribution system, and built into the vehicle structure to direct deicing fluid, for a short period of time, followed by heated water onto the upper surfaces of, the front, rear and, optionally, the side windows of the vehicle, in the form of a spray.

CLAIM 9. A device as claimed in claims 1 to 8 wherein the capacity of the outer compartment is increased in relation to the inner chamber by a factor of up to 10 : 1 , to ensure a sufficient water supply for multiple use of the device on large vehicles. The external shape of the device is suitable for its installation in an area of the vehicles structure other than the engine compartment, such as the luggage compartment of a car or van, or on the underside of the chassis of high axel height vehicles. The filling orifice of the device being built into the vehicle in such a manner as to permit access from outside the vehicle.

CLAIM 10. A device as claimed in claims 1 to 9 wherein the heated water distribution pump is activated by remote control.

CLAIM 11. A device for heating, storing and distributing the heated water, and optionally deicing fluid, on the windscreen and other windows of a motor vehicle substantially as described herein with reference to figures 1 to 14 of the accompanying drawings.

Figure 1



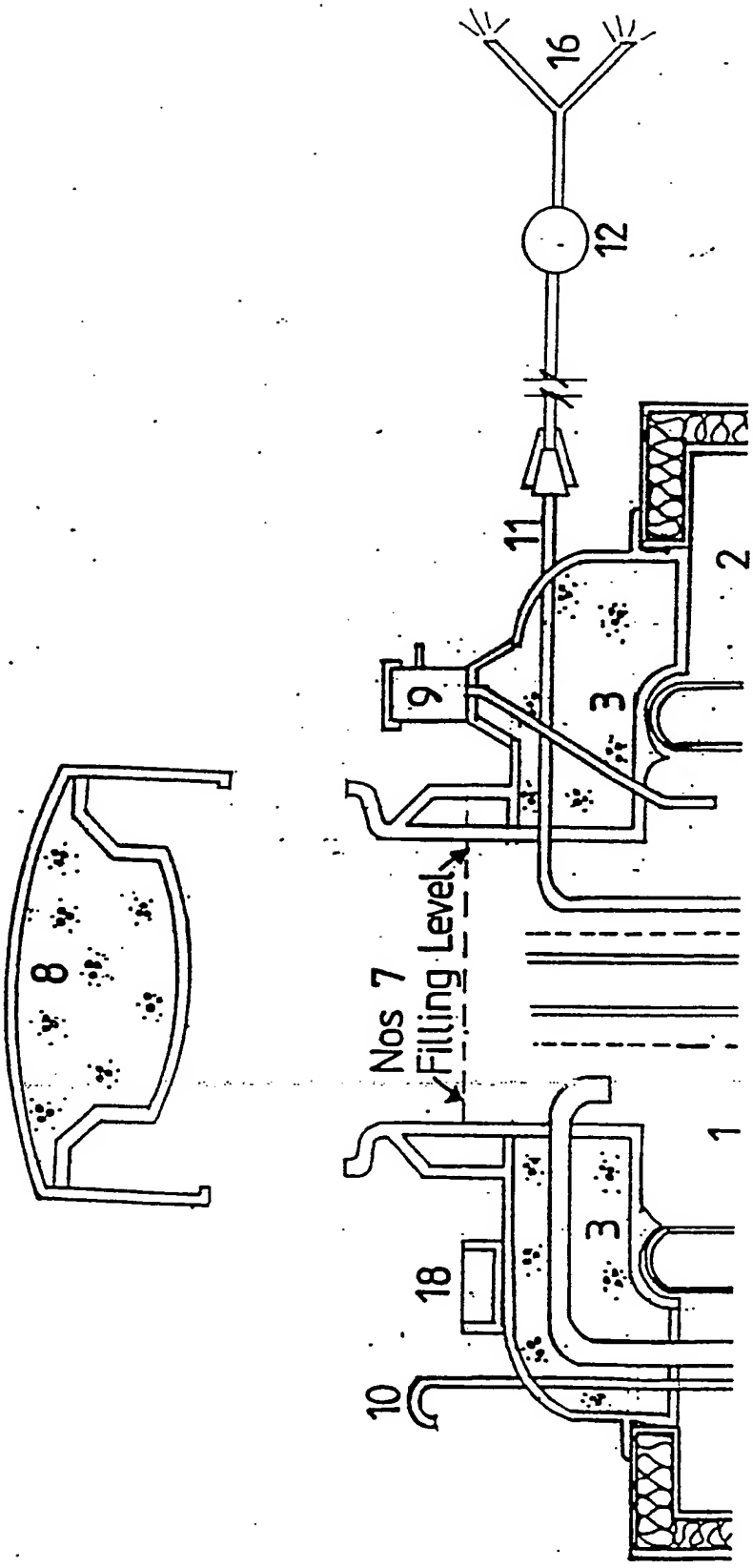


Figure 2

Figure 3

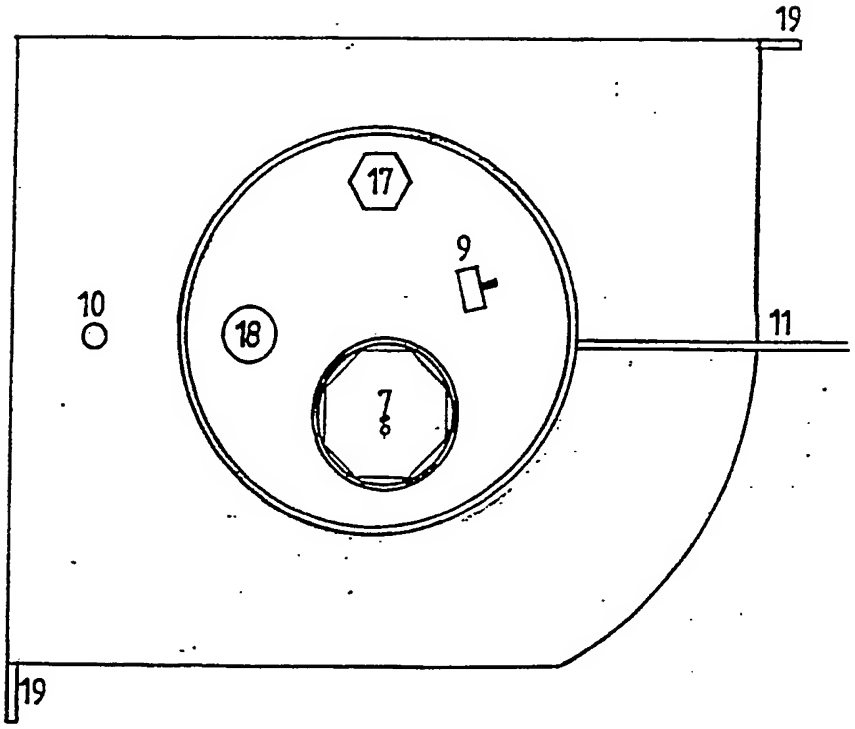


Fig. 3

Figure 4

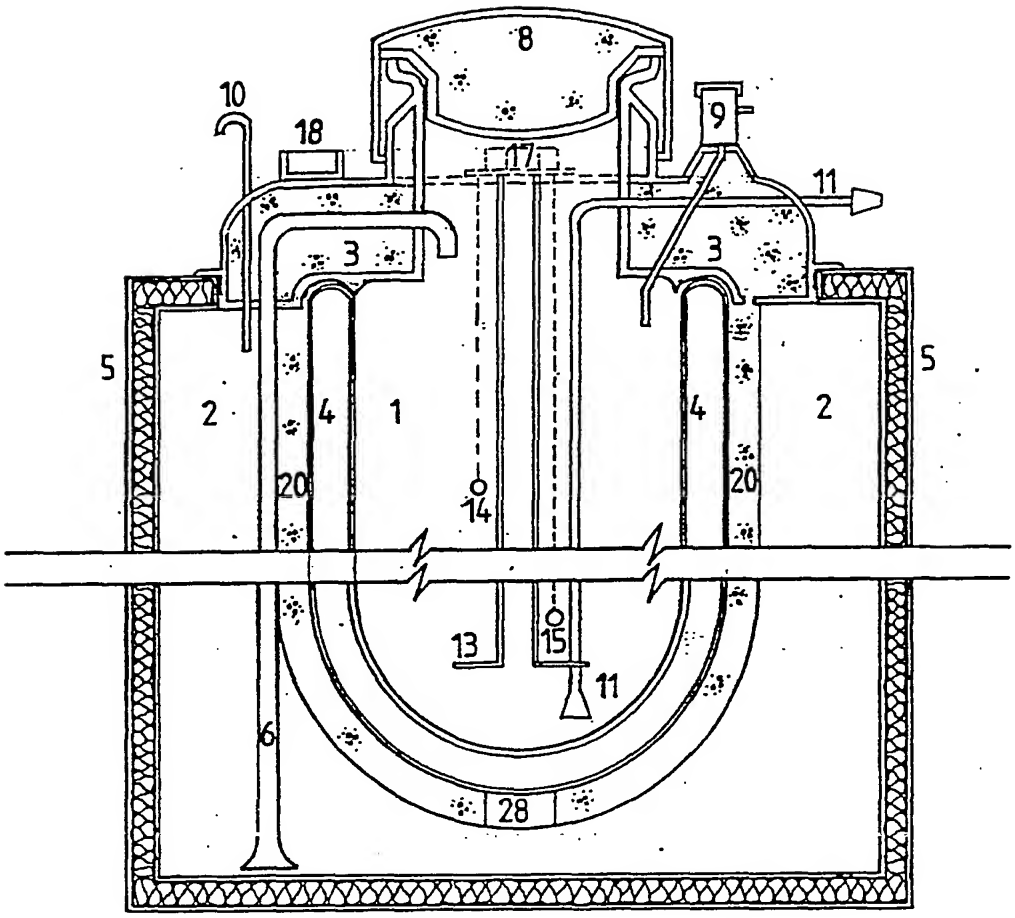


Figure 5

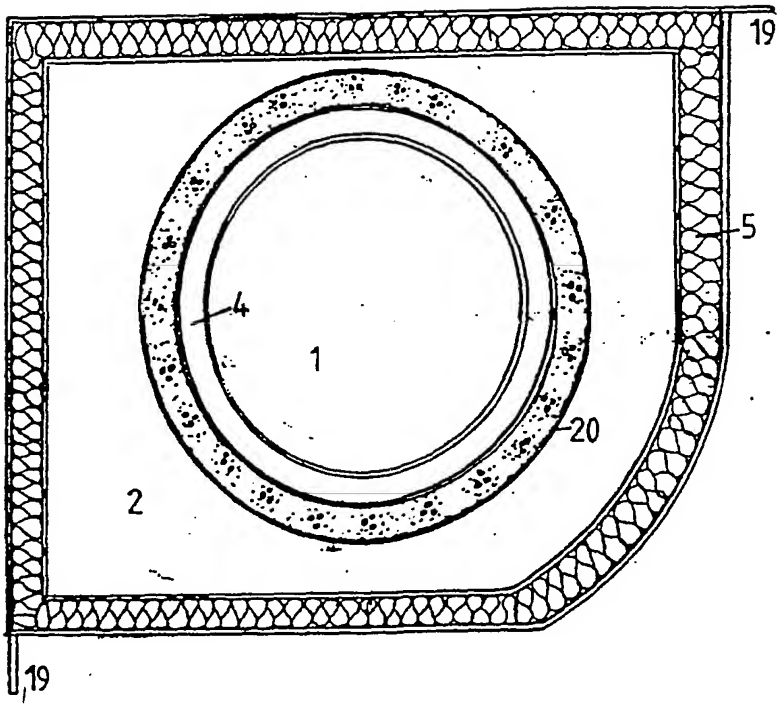


Figure 6

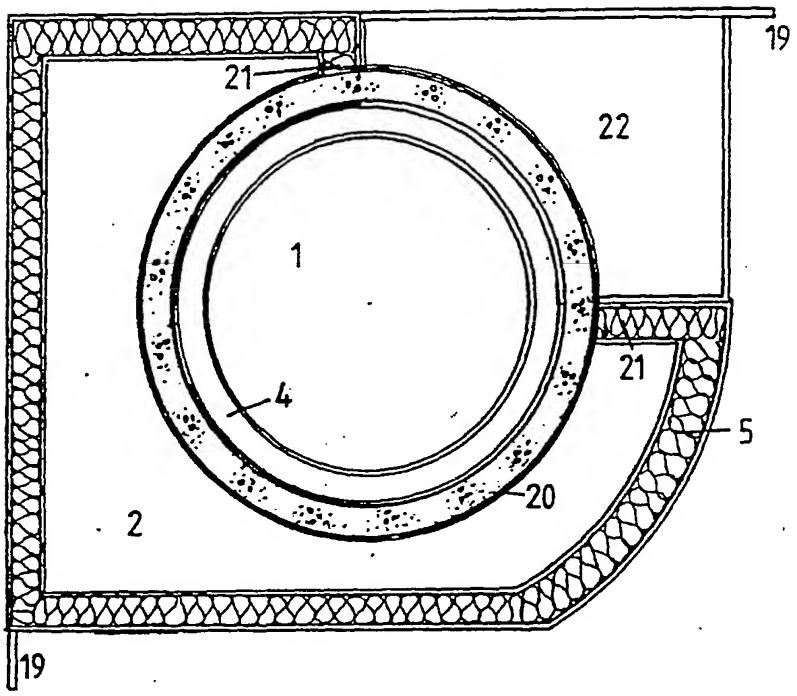
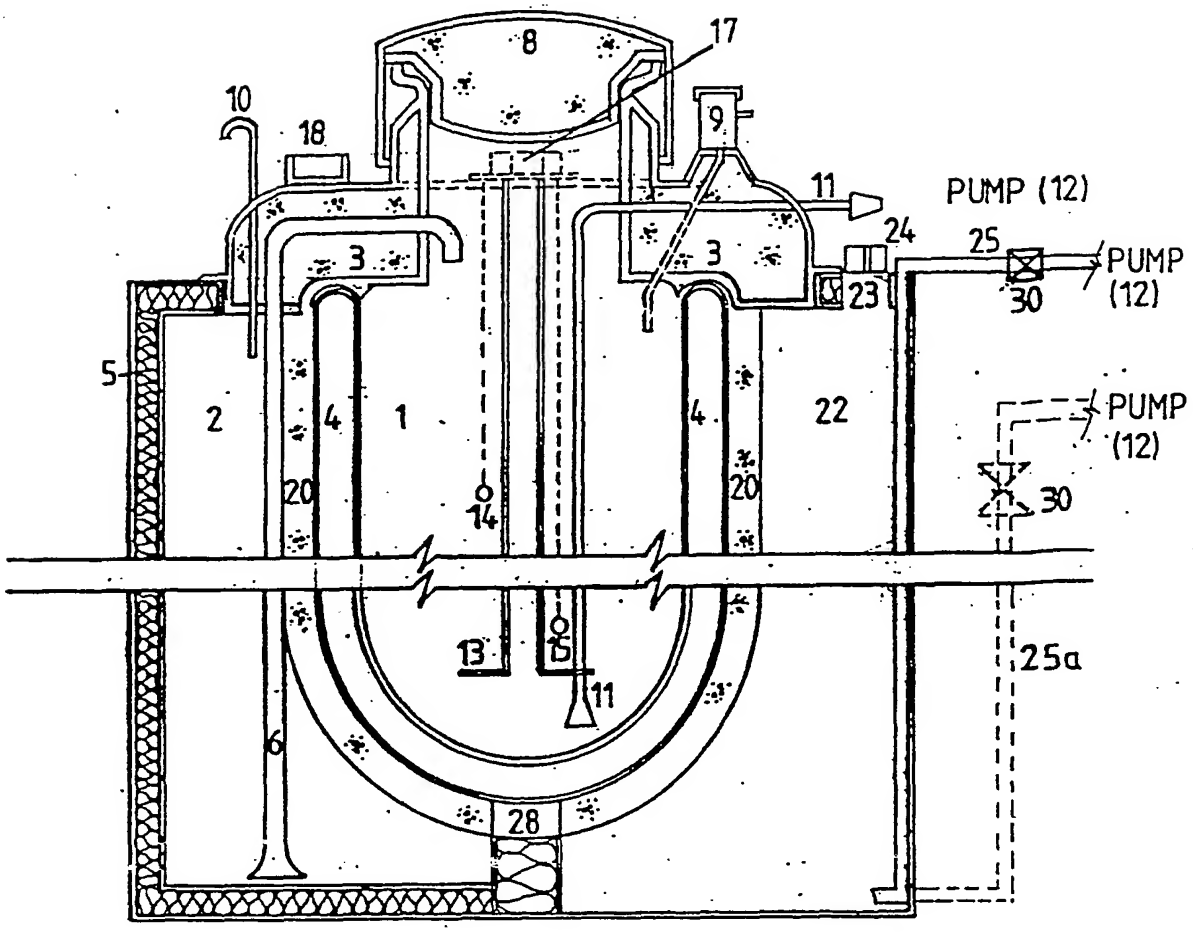


Figure 7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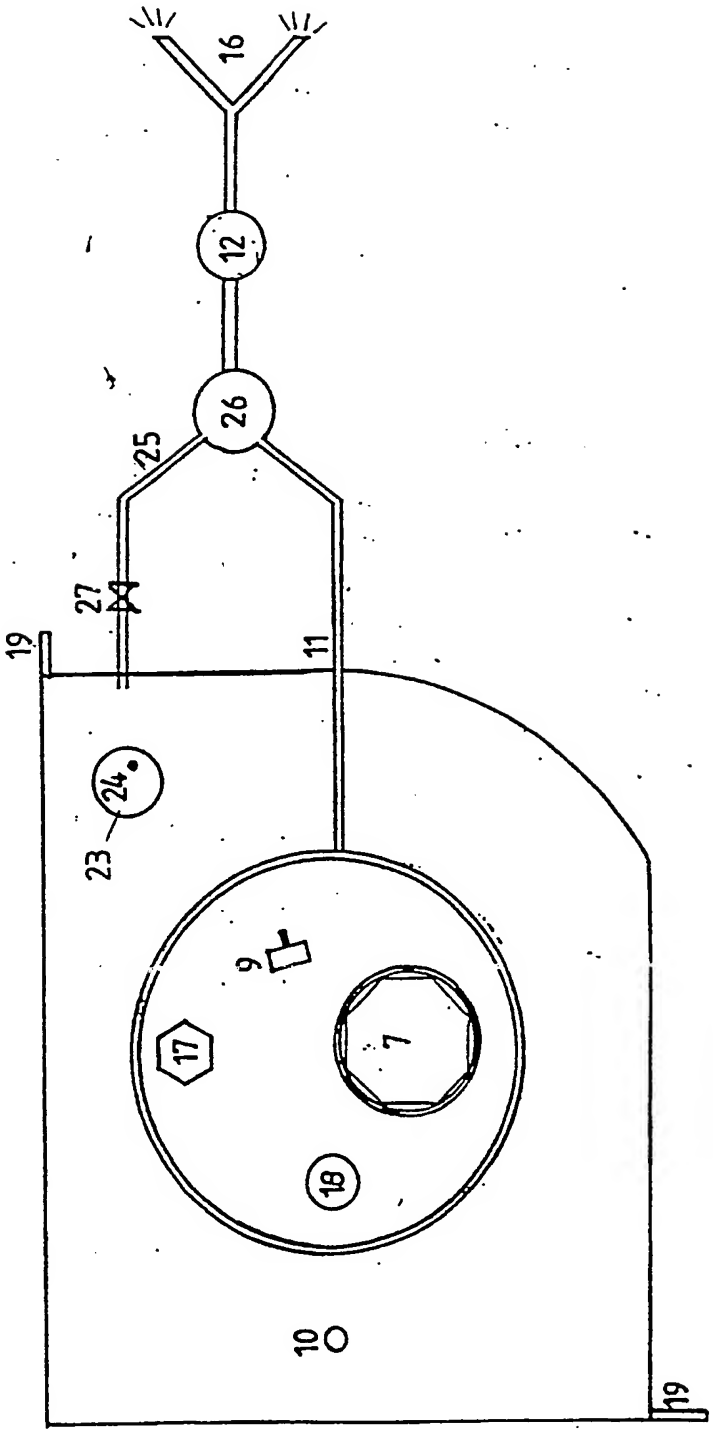

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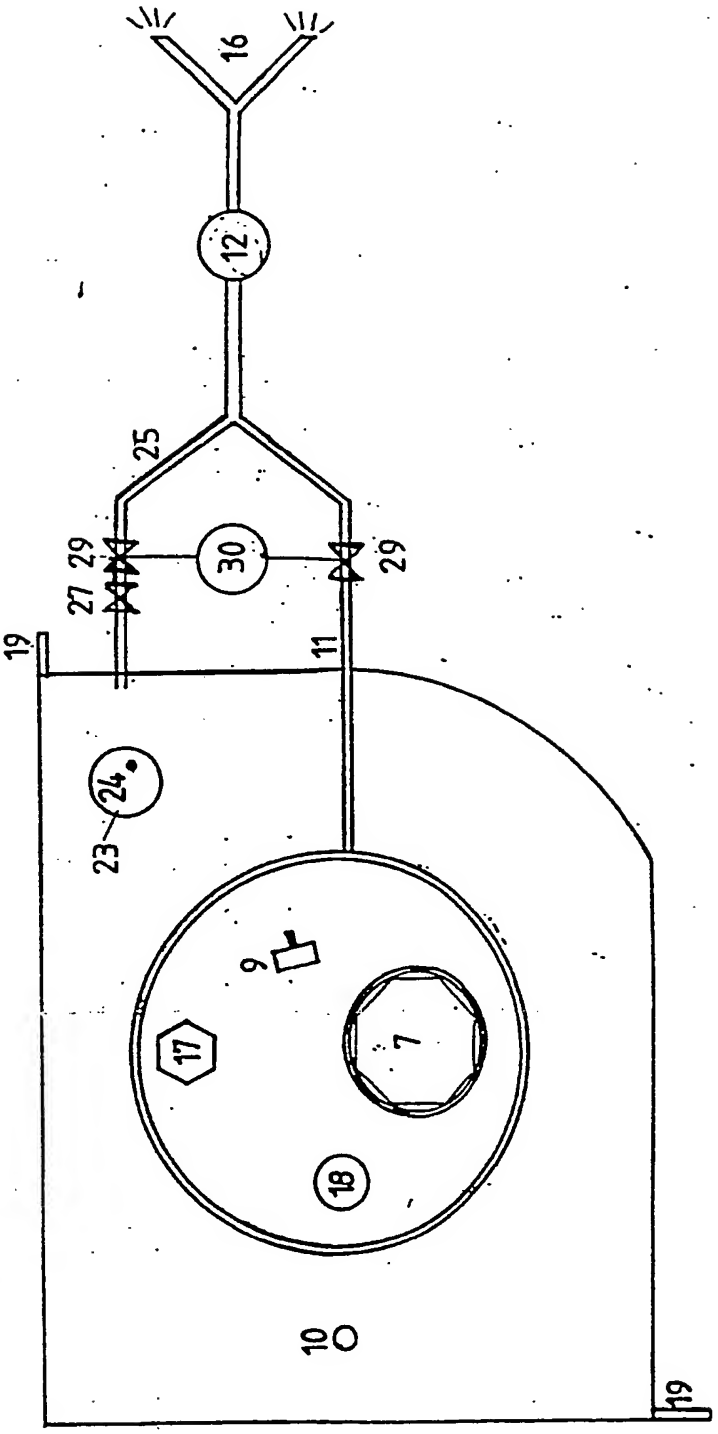

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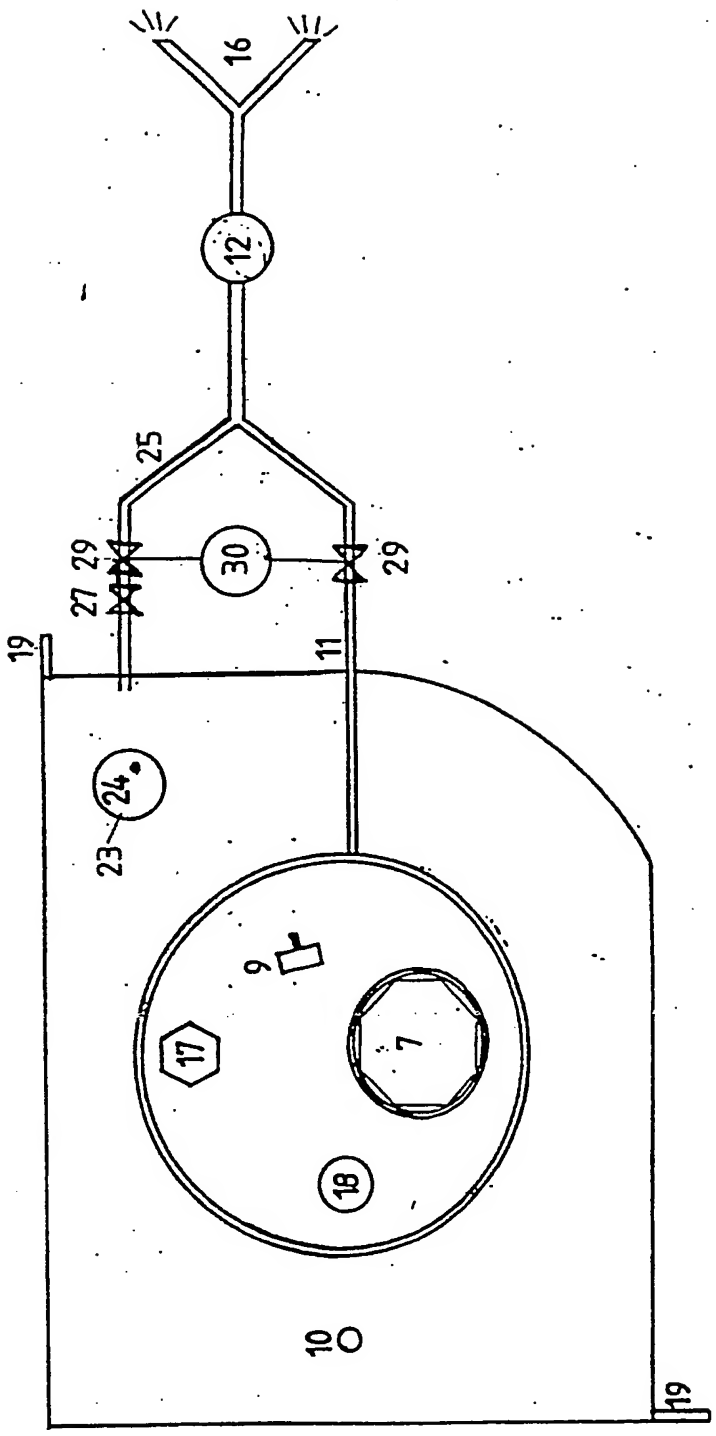


Figure 9

Figure 10

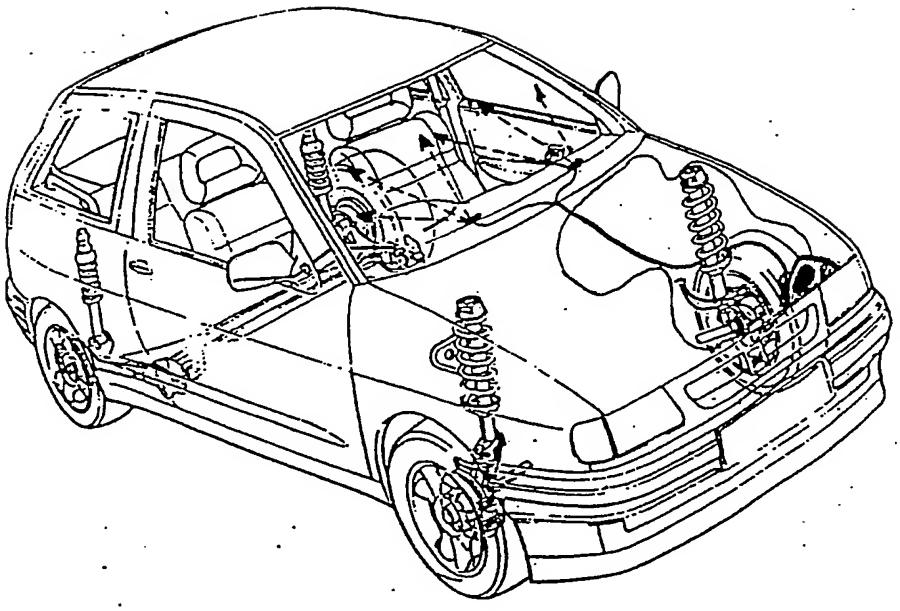


Figure 11

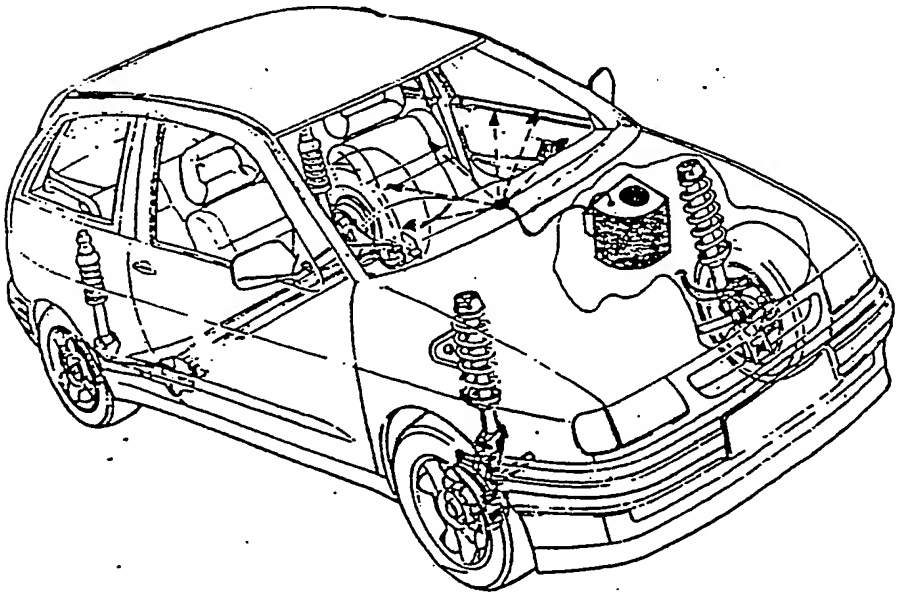


Figure 12

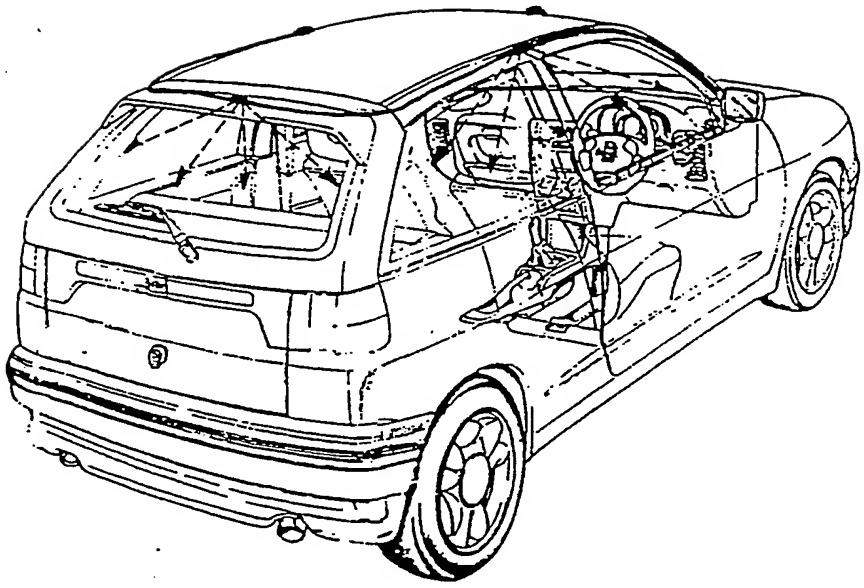
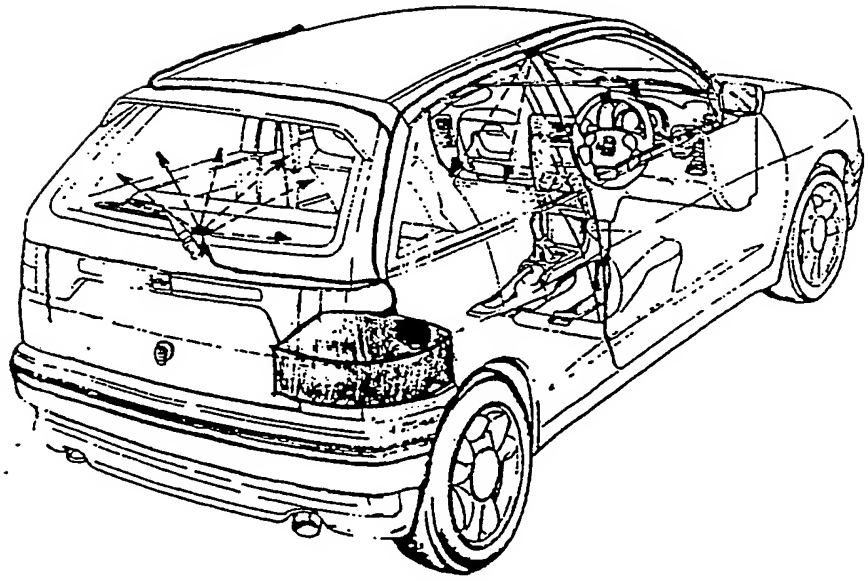
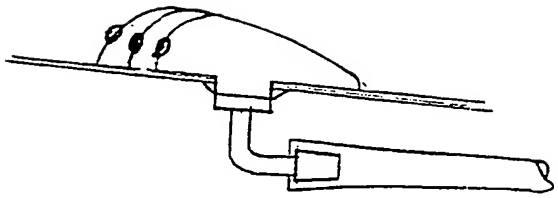
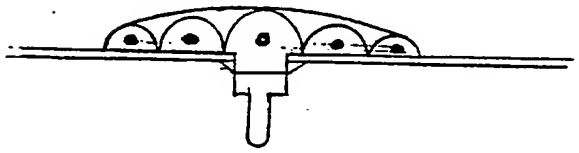


Figure 13





SPRAYING NOZZLE SIDE ELEVATION



SPRAYING NOZZLE FRONT ELEVATION

Figure 14

The Patent Office

Application No: GB 9412700.8
Claims searched: 1 at least

Examiner: A C Howard
Date of search: 20 June 1995

Patents Act 1977
Search Report under Section 17

Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.N): A4F (FAMA, FAMC, FAMD)

Int Cl (Ed.6): B60S 1/48, 1/50

Other: Online: WPI

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
Y	GB 2271276 A	MACKAY (see pages 9-11 and Fig. 6)	1 at least
Y	GB 1451666	ASSOCIATED ENGINEERING (see Fig. 1)	1 at least
Y	US 5118040	ABE (see Fig. 1)	1 at least
Y	US 4090668	KOCHENOUR (see Fig. 3)	1 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.